WHAT IS CLAIMED IS:

1.    A position detection apparatus for detecting a
position of a mark on an object, comprising:

an extraction section for observing the mark and
5    extracting a plurality of edge information of the mark in
correspondence with attribute information representing
features of the edge information, respectively;

a position determination section for comparing each
edge information with one of a plurality of templates, which
10   is specified by attribute information corresponding to the
edge information and evaluating a plurality of comparison
results obtained by comparison to determine the position
of the mark; and

a control section for changing at least one of an
15   extraction rule in said extraction section and an
evaluation rule in said position determination section on
the basis of the plurality of comparison results by said
position determination section and causing said extraction
section and said position determination section to execute
20   processing again.

2.    The apparatus according to claim 1, wherein each
attribute information represents an edge portion of the
mark, which is associated with the corresponding edge
information.

25   3.    The apparatus according to claim 1, wherein each
attribute information represents one of a plurality of

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extraction conditions under which the corresponding edge information is extracted.

4.    The apparatus according to claim 1, wherein said extraction section extracts, as each edge information, information representing an edge position shifted from an actual edge position of the mark by a predetermined distance in one of a plurality of predetermined directions, and each attribute information represents a direction in which an edge position associated with the corresponding edge information shifted from the actual edge position of the mark by the predetermined distance.

5.    The apparatus according to claim 1, wherein said extraction section comprises:

an image sensing section for sensing an image of the mark;

a differential processing section for differentiating the mark image as an image sensing result; and

an edge information generation section for processing the differential result to generate the edge information corresponding to the attribute information.

6.    The apparatus according to claim 5, wherein said differential processing section calculates a change rate of an image signal of the mark image along at least two directions of the mark image, and

each attribute information is associated with one of

the at least two directions.

7.    The apparatus according to claim 5, wherein each attribute information is associated with a sign of the differential result by said differential processing

5    section.

8.    The apparatus according to claim 6, wherein each attribute information is associated with a sign of the differential result by said differential processing section.

10    9.    The apparatus according to claim 5, wherein said differential processing section calculates a change rate of an image signal of the mark image across the mark image along row and column directions of the mark image, and

each attribute information is associated with one of

15    the row and column directions and the differential result by said differential processing section.

10.    The apparatus according to claim 1, wherein each template includes, as information to be compared with the edge information, position information of a plurality of

20    points defining a corresponding edge.

11.    The apparatus according to claim 1, wherein said extraction section performs noise removal processing for an observation result of the mark and then executes edge information extraction.

25    12.    The apparatus according to claim 1, wherein said extraction section increases a line width associated with

the extracted edge information.

13. The apparatus according to claim 1, wherein the extraction rule and/or the evaluation rule determined by said control section is stored in a memory and used as a base for processing to be executed later.

14. The apparatus according to claim 1, wherein said extraction section observes the mark under dark field illumination.

15. A position detection apparatus for detecting a position of a mark on an object, comprising:

an extraction section for observing the mark and extracting edge information of the mark;

a position determination section for comparing the edge information with a template and evaluating a comparison result to determine the position of the mark; and

a control section for changing at least one of an extraction rule in said extraction section and an evaluation rule in said position determination section on the basis of the evaluation result by said position determination section and causing said extraction section and said position determination section to execute processing again.

16. An exposure apparatus comprising:

a projection optical system for projecting a pattern onto a substrate;

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a chuck on which the substrate is placed; and

a position detection section for detecting a position of a mark on the substrate placed on said chuck,

wherein the substrate is aligned on the basis of a

5   detection result by said position detection section, and then, the substrate is exposed using the pattern,

said position detection section comprising:

an extraction section for observing the mark and extracting a plurality of edge information of the mark in

10   correspondence with attribute information representing features of the edge information, respectively;

a position determination section for comparing each edge information with one of a plurality of templates, which is specified by attribute information corresponding to the

15   edge information and evaluating a plurality of comparison results obtained by comparison to determine the position of the mark; and

a control section for changing at least one of an extraction rule in said extraction section and an

20   evaluation rule in said position determination section on the basis of the plurality of comparison results by said position determination section and causing said extraction section and said position determination section to execute processing again.

25   17.   The apparatus according to claim 16, wherein said extraction section of said position detection section

observes the mark with an off-axis scope.

18. The apparatus according to claim 16, wherein said extraction section of said position detection section observes the mark by TTR (Through The Reticle).

5  19. The apparatus according to claim 16, wherein said extraction section of said position detection section observes the mark by TTL (Through The Lens).

20. The apparatus according to claim 16, wherein each attribute information represents an edge portion of the
10  mark, which is associated with the corresponding edge information.

21. The apparatus according to claim 16, wherein each attribute information represents one of a plurality of extraction conditions under which the corresponding edge
15  information is extracted.

22. The apparatus according to claim 16, wherein said extraction section extracts, as each edge information; information representing an edge position shifted from an actual edge position of the mark by a predetermined distance
20  in one of a plurality of predetermined directions, and each attribute information represents a direction in which an edge position associated with the corresponding edge information shifted from the actual edge position of the mark by the predetermined distance.

25  23. The apparatus according to claim 16, wherein said extraction section comprises:

an image sensing section for sensing an image of the mark;

a differential processing section for differentiating the mark image as an image sensing result; and

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an edge information generation section for processing the differential result to generate the edge information corresponding to the attribute information.

24. The apparatus according to claim 23, wherein said

10 differential processing section calculates a change rate of an image signal of the mark image along at least two directions of the mark image, and

each attribute information is associated with one of the at least two directions.

15 25. The apparatus according to claim 23, wherein each attribute information is associated with a sign of the differential result by said differential processing section.

26. The apparatus according to claim 24, wherein each

20 attribute information is associated with a sign of the differential result by said differential processing section.

27. The apparatus according to claim 23, wherein said differential processing section calculates a change rate

25 of an image signal of the mark image across the mark image along row and column directions of the mark image, and

each attribute information is associated with one of the row and column directions and the differential result by said differential processing section.

28. The apparatus according to claim 16, wherein each template includes, as information to be compared with the edge information, position information of a plurality of points defining a corresponding edge.

29. The apparatus according to claim 16, wherein each template includes, as information to be compared with the edge information, position information of points on a continuous line defining a corresponding edge.

30. The apparatus according to claim 16, wherein said extraction section performs noise removal processing for an observation result of the mark and then executes edge information extraction.

31. The apparatus according to claim 16, wherein said extraction section increases a line width associated with the extracted edge information.

32. The apparatus according to claim 16, wherein the extraction rule and/or the evaluation rule determined by said control section is stored in a memory and used as a base for processing to be executed later.

33. The apparatus according to claim 16, wherein said extraction section observes the mark under dark field illumination.

34. An exposure apparatus comprising:

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a projection optical system for projecting a pattern onto a substrate;

a chuck on which the substrate is placed; and

a position detection section for detecting a position

5    of a mark on the substrate placed on said chuck,

wherein the substrate is aligned on the basis of a detection result by said position detection section, and then, the substrate is exposed using the pattern,

said position detection section comprising:

10    an extraction section for observing the mark and extracting edge information of the mark;

a position determination section for comparing the edge information with a template and evaluating a comparison result to determine the position of the mark;

15    and

a control section for changing at least one of an extraction rule in said extraction section and an evaluation rule in said position determination section on the basis of the evaluation result by said position

20    determination section and causing said extraction section and said position determination section to execute processing again.

35.    A position detection method of detecting a position of a mark on an object, comprising:

25    the extraction step of observing the mark and extracting a plurality of edge information of the mark in

correspondence with attribute information representing features of the edge information, respectively;

the position determination step of comparing each edge information with one of a plurality of templates, which

5    is specified by attribute information corresponding to the edge information and evaluating a plurality of comparison results obtained by comparison to determine the position of the mark; and

the control step of changing at least one of an

10    extraction rule in the extraction step and an evaluation rule in the position determination step on the basis of the plurality of comparison results in the position determination step and causing the extraction step and the position determination step to execute processing again.

15    36.    A position detection method of detecting a position of a mark on an object, comprising:

the extraction step of observing the mark and extracting edge information of the mark;

the position determination step of comparing the edge

20    information with a template and evaluating a comparison result to determine the position of the mark; and

the control step of changing at least one of an extraction rule in the extraction step and an evaluation rule in the position determination step on the basis of the

25    evaluation result in the position determination step and causing the extraction step and the position determination

step to execute processing again.